

Notice of Allowability

Application No.

09/494,817

Examiner

Kenneth Tang

Applicant(s)

JOHL ET AL.

Art Unit

2195

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 3/9/05.
2. ☒ The allowed claim(s) is/are 1-8, 10-14, and 16-20; now renumbered as 1-18.
3. ☒ The drawings filed on 14 August 2000 are accepted by the Examiner.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
 6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☒ Interview Summary (PTO-413), Paper No./Mail Date 6/21/05.
7. ☒ Examiner's Amendment/Comment
8. ☐ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____

MENG-ALAN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2-11

EXAMINER'S AMENDMENT

1. ✓ An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it **MUST** be submitted no later than the payment of the issue fee.
2. Authorization for this examiner's amendment was given in a telephone interview with Kevin Jablonski (Reg. No. 50,401) on 6/21/05.
3. Please amend the claims according to the email attachment sent by the Applicant on 6/21/05.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kenneth Tang whose telephone number is (571) 272-3772. The examiner can normally be reached on 8:30AM - 6:00PM, Every other Friday off.

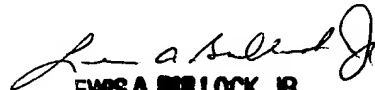
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Meng-Ai An can be reached on (571) 272-3756. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Kt
6/21/05

FOR MENG AN


LEWIS A. BULLOCK, JR.
PRIMARY EXAMINER

Requested by
Examiner
6/21/05 KT

Tang, Kenneth

From: Kevin D. Jablonski [kdj@jablonskiandreid.com]
Sent: Tuesday, June 21, 2005 1:03 PM
To: Tang, Kenneth
Subject: Proposed Examiner Amendment for 09/494,817

Examiner Tang,

I have put together a proposed Examiner amendment for the patent application (09/494,817) that we discussed on the phone yesterday. I believe this captures the essence of what we discussed.

Best Regards

Kevin D. Jablonski

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6/21/05

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE APPLICATION OF: Johl et al.
APPLICATION NO.: 09/494,817
FILED: January 31, 2000
FOR: Method and System for Increasing
Performance by Substituting Finite State
Machine Control with Hardware-Implemented
Data Structure Manipulation

EXAMINER: K. Tang
ART UNIT: 2127
CONF. NO: 3999

Proposed Examiner Amendment

Listing of the Claims:

1. (currently amended) A method for implementing a hardware controller that concurrently executes a number of tasks by carrying out operations on behalf of the tasks, the method comprising:
 - determining a format for a context, comprising stored information related to a task, that represents the task;
 - determining possible states, and transitions between states, that a context representing a task currently executed by the hardware controller can occupy at each point in the execution of the task, transitions representing operations performed on behalf of a task by the hardware controller;
 - partitioning the states and operations carried out by the hardware controller into a number of managers each containing a number of related states and carrying out a number of operations;

associating each manager with a data structure for storing contexts
occupying states contained by the manager;

defining a data-structure-manipulator manager that implements the data
structures and that transfers contexts from one data structure to another;

defining a command interface to the data-structure-manipulator manager
for each manager; and

implementing the managers and data-structure-manipulator manager,
according to the determined states and transitions, so that, when a first
manager carries out an operation that results in transition of a context to a state
contained in a second manager, the first manager generates a command to the
data-structure-manipulator manager to transfer the context from the data
structure associated with the first manager to the data structure associated with
the second manager such that timing of the hardware controller is controlled by
a clock circuit that generates clock signals that define clock cycles, wherein
each logical manager may issue at most one command to the data-structure
manipulator during each clock cycle, and wherein the data-structure manipulator
concurrently executes commands issued by the logical managers during a clock
cycle by serializing the commands according to a defined precedence ordering
of the commands.

2. (original) The method of claim 1 wherein tasks are provided to the
hardware controller via a signal interface, wherein the hardware controller
generates output signals and output data as a result of execution of a task, and
wherein operations carried out by managers can be invoked via a signal
interface provided for each manager.

3. (previously amended) The method of claim 1 wherein the data-structure-manipulator manager comprises a manipulator logic circuit for each manager, a manipulator logic circuit for a manager together with the command interface defined for the manager composing a manipulator within the data-structure-manipulator manager corresponding to the manager.

4. (previously amended) The method of claim 3 wherein the hardware controller includes a timing circuit that generates clock signals ~~are~~ at regular intervals, the intervals including and following a first clock signal and preceding a next clock signal composing a clock cycle, wherein each manager can issue a single command to the manipulator associated with the manager during a single clock cycle, and wherein each manipulator can receive a number of contexts during a single clock cycle for transfer to the data structure associated with the manager corresponding to the manipulator.

5. (original) The method of claim 4 wherein each manipulator can receive a number of commands from a number of managers during each clock cycle.

6. (original) The method of claim 5 wherein related contexts can be linked to one another to form a chain of related contexts that can be transferred together by transferring the first context of the chain of related contexts.

7. (original) The method of claim 6 applied to an outbound sequence manager functionality of a fibre channel interface controller to implement an outbound sequence manager having contexts that store information supplied to the outbound sequence manager in outbound descriptor blocks and having doubly linked-list data structures associated with each manager for storing contexts occupying states contained in the manager, the outbound sequence manager comprising:

- a completion manager associated with a completion doubly linked-list;
- a credit manager associated with a timer doubly linked-list;
- a transmit manager associated with a transmit doubly linked-list;
- an outbound descriptor block manager associated with a free doubly linked-list;
- a rogue manager associated with a free doubly linked-list;
- a non-fabric daemon manager associated with a non-fabric doubly linked-list; and
- a centralized list manager data-structure-manipulator manager that transfers contexts from one doubly linked-list to another in response to commands issued to the centralized list manager by the completion manager, credit manager, transmit manager, outbound descriptor manager, rogue manager, and non-fabric daemon, the centralized list manager having a timer list manipulator, a free list manipulator, a non-fabric list manipulator, a transmit list manipulator, and a completion list manipulator.

8. (currently amended) A method for implementing a hardware controller that concurrently executes a number of tasks, the method comprising:

representing each task executed by the hardware controller as a context, each context occupying a state determined by the contents of at least one field within the context, a context transitioning from one state to another state when the hardware controller carries out an operation on behalf of the task represented by the context, wherein timing of the hardware controller is controlled by a clock circuit that generates clock signals that define clock cycles, wherein each logical manager may issue at most one command to the data-structure manipulator during each clock cycle, and wherein the data-structure manipulator concurrently executes commands issued by the logical managers during a clock cycle by serializing the commands according to a defined precedence ordering of the commands;

partitioning hardware controller operations and associated context states into a number of logical managers;

associating each logical manager with one of a number logical data structures for storing contexts occupying states within the logical manager; and

implementing the logical managers and a data-structure manipulator that contains the contexts, logical data structures, and a command interface through which each logical manager issues commands to direct the data-structure manipulator to transfer a context from the data structure associated with the logical manager to a different data structure.

9. (cancelled)

10. (original) The method of claim 8 wherein the data structures are chosen for efficient storage and retrieval of contexts according to the operations

carried out by one or more logical managers associated with the contexts, the data structures chosen from among well-known data structures employed in software programming, including:

- singly linked lists;
- doubly linked lists;
- first-in-first-out queues;
- first-in-last-out queues;
- stacks;
- Graphs;
- acyclic graphs, such as binary trees;
- arrays;
- circular queues; and
- combinations of the well-known data structures.

11. (original) The method of claim 8 wherein each logical manager is associated with a signal interface for input and output of signals, wherein operations carried out by logical managers are invoked by signals received through the signal interfaces, and wherein the hardware controller receives tasks and control signals and output data and control signals through a hardware controller interface.

12. (original) The method of claim 11 wherein the hardware controller receives a task via the hardware controller interface and executes the task by:

- storing information related to the task within the hardware controller and
- initializing a context to represent the task;

adding the context to the data structure;

carrying out operations on behalf of the context by the logical manager associated with the data structure in which the context is located, and, when carrying out an operation by a first logical manager results in transition of the context to a state in a second logical manager associated with a different data structure than the data structure in which the context is located, issuing a command from the first logical manager to the data-structure manipulator to transfer the context to the different data structure; and

when all operations that need to be carried out by the hardware controller to execute the task are carried out, generating output data and output signals corresponding to completion of the task by the hardware controller and freeing the context for representing a subsequently received task.

13. (currently amended) A subcomponent controller within a communication controller comprising:

data storage elements that together compose a number of contexts for storing information related to a sequence of data to be exchanged through a communications medium connected to the communication controller;

logical managers that are each associated with a data structure and that each carries out operations on behalf of contexts stored within the associated data structure, wherein each logical manager may issue a single context transfer command during a single clock cycle, wherein the data-structure manipulator can concurrently receive and carry out one transfer command received from each logical manager during a single clock cycle, wherein the data-structure manipulator serializes all commands received during a single

clock cycle by carrying out the commands logically in a predetermined
precedence order; and

a data-structure manipulator that implements a number of data structures for storing contexts and that transfer contexts between data structures in response to receiving transfer commands from the logical managers.

14. (original) The subcomponent controller of claim 13 wherein the subcomponent interfaces with external subcomponent controllers via a signal interface and wherein the subcomponent controller receives timing signals at regular intervals that define clock cycles.

15. (cancelled)

16. (original) The subcomponent controller of claim 13 wherein the communications controller is a fibre channel interface controller and wherein the communications medium is a fibre channel communications medium.

17. (original) The subcomponent controller of claim 16 wherein the subcomponent controller is an outbound sequence manager that receives outbound descriptor blocks from an external subcomponent, stores information related to an outbound sequence and represents a received outbound sequence with a context, and that provides fibre channel frames to an external subcomponent for transmission to the fibre channel medium as a result of executing a task corresponding to a received outbound descriptor block.

18. (original) The subcomponent controller of claim 17 wherein the data structures are doubly linked lists of contexts in which each context may reference a single linked list of related contexts.

19. (previously amended) The subcomponent controller of claim 18 wherein the logical managers include:

- a completion manager associated with a completion list;
- a credit manager associated with a timer list;
- a transmit manager associated with a transmit list;
- an outbound descriptor block manager associated with a free list;
- a rogue manager associated with a free list;
- a non-fabric daemon manager associated with a non-fabric list; and
- a centralized list manager that serves as the data-structure manipulator to transfer contexts between lists.

20. (original) The subcomponent controller of claim 19 wherein:

- the completion manager can issue commands to the centralized list manager to transfer a context from the completion list to the free list, to transfer a first context from the completion list to the free list and dechain related contexts from the first context and transfer the related contexts to the transmit list, to transfer a first context from the completion list to the free list and dechain related contexts from the first context and transfer related contexts to the completion list, and to transfer a first context from the completion list to the free list and to dechain related contexts from the first context and transfer related contexts to the non-fabric list;

the credit manager can issue commands to the centralized list manager to transfer a context from the timer list to the transmit list, non-fabric list, or the completion list;

the transmit manager can issue commands to the centralized list manager to transfer a context from the transmit list to the timer list or the completion list;

the outbound descriptor block manager can issue commands to the centralized list manager to transfer a context from the free list to the transmit list of the non-fabric list; and

the non-fabric daemon can issue commands to the centralized list manager to transfer a context from the non-fabric list to the transmit list.